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ABSTRACT

A national sample survey of innovation processes reported by superintendents in 353 school districts reveals four distinct patterns of belief regarding change. These four patterns are identified as "participative problem solving," "RD&D," "strategic manipulation," and "open advocacy-human revolution." Three of the four correspond closely to "perspectives" identified by the author in a previous review of the literature on planned change and knowledge utilization. Important "barriers" to innovation were also analyzed and appeared to show a large general factor related to teacher confusion and lack of information about the innovation, and a secondary factor related to financial capacity. A bibliography is included. (Author)

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MODELS OF THE INNOVATION PROCESS IN U.S. SCHOOL DISTRICTS*

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Five years ago we reported to an AERA symposium on an extensive review of the literature on planned change and knowledge utilization. From that review we concluded that there were three very distinct and competing ideologies represented in the writings of different theorists which we characterized as "problem solving," "RD&D," and "social interaction." Since that time we have had an opportunity to test our conclusions in a somewhat more empirical manner with rather interesting results.

The findings which I wish to report on here are derived from a national survey of innovation in U.S. school districts for the 1970-71 school year. A random sample of 500 school districts was drawn, stratified by size of student population, and a questionnaire form was mailed to each selected superintendent. With considerable follow-up effort, we managed to get responses from 353, a little over 70%. The form elicited quite a bit of information on resource linkage and utilization and various aspects of school functioning which might be related to innovation, but the key questions were focused on a single innovation. Each superintendent was asked to identify one innovation which represented the major change effort in his schools during that year. Then he was asked to describe the process by which it was introduced, developed, implemented, and so forth. We have reported

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elsewhere on most of these findings (Havelock and Havelock, 1973 and Havelock, 1973). What we want to report on here are the responses of these superintendents to a list of 21 statements which we had drawn up intentionally to represent the three clusters of ideology from our earlier literature review.

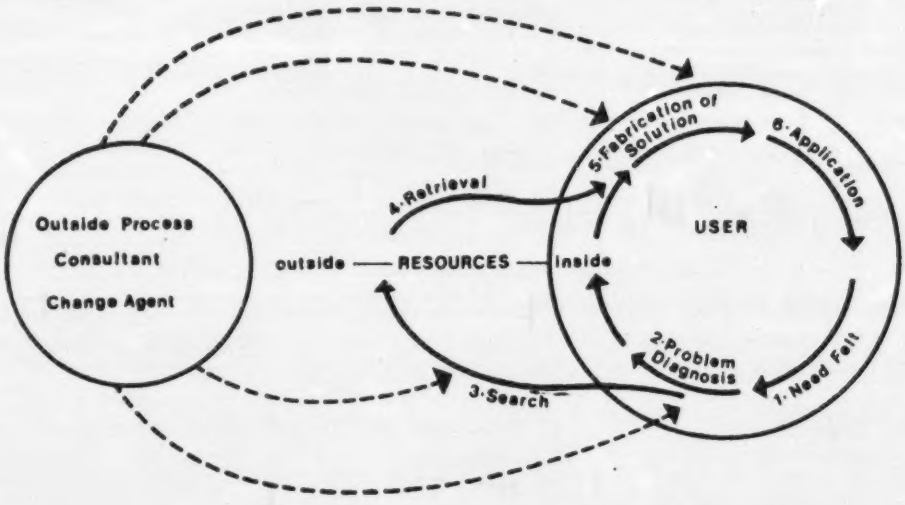
A. THEORETICAL PERSPECTIVES ON INNOVATION PROCESS

Let me recall briefly what those three clusters were.

1. PROBLEM SOLVING (P-S)

What we call the "problem-solving" model rests on the primary assumption that innovation is a part of a problem-solving process which goes on inside the user. Problem-solving is usually seen as a patterned sequence of activities beginning with a *need*, sensed and articulated by the client, which is translated into a *problem* statement and *diagnosis*. When he has thus formulated a problem statement, the client-user is able to conduct a meaningful *search* and *retrieval* of ideas and information which can be used in formulating or selecting the *innovation*. Finally the user needs to concern himself with *adapting* the

FIGURE 1 THE PROBLEM-SOLVER PERSPECTIVE



innovation, *trying out* and *evaluating* its effectiveness in *satisfying* his original need. The focus of this orientation is the user, himself, his needs and what he does about satisfying his needs. The role of outsiders is therefore consultative or collaborative. The outside change agent may assist the user either by providing new ideas and innovations specific to the diagnosis or by providing guidance on the process of problem-solving at any or all of the indicated stages.

At least five points are generally stressed by advocates of this orientation: first, that *user need* is the paramount consideration and the only acceptable value-stance for the change agent; second, that *diagnosis* of need always has to be an integral part of the total process; third, that the outside change agent should be *nondirective,* rarely, if ever, violating the integrity of the user by placing himself in a directive or expert status; fourth, that the *internal* resources, i.e., those resources already existing and easily accessible within the client system, itself, should always be fully utilized; and fifth, that *self-initiated and self-applied innovation* will have the strongest user commitment and the best chances for long-term survival.

If the "user" is a group or an organization, the problem-solver consultant role also is likely to include training in group communication, the building of group or organizational self-awareness and cohesiveness, and emphasis on *collaboration* among the members of the user system in solving their problems with as wide a circle of participation as possible.

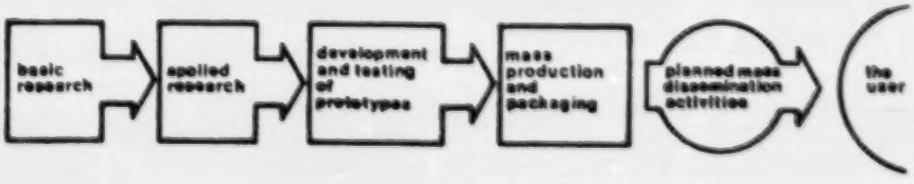
A few of the major advocates of this orientation are Lippitt, et al. (1958), Watson (1967), Jung (1970), and Thelen (1967). Most of those who belong to this school are social psychologists in the group dynamics-human relations tradition.

2. RESEARCH, DEVELOPMENT, AND DIFFUSION (RD&D)

The "RD&D" perspective is guided by at least five assumptions. First, it assumes that there should be a *rational sequence* in the evolution and application of an innovation. This sequence should include research, development, and packaging before mass dissemination takes place. Second, it assumes that there had to be planning, usually on a massive scale over a long time span. Such planning and ordering of stages from initiation to the achievement of stated objectives allows for systematic budgeting, monitoring, and scientific evaluation at each stage. Third, it assumes that there has to be a *division and coordination of labor* to accord with the rational sequence and the planning. Fourth, it makes the assumption of a more-or-less *passive but rational consumer* who will accept and adopt the innovation if it is offered to him in the right place at the right time and in the right form. Fifth, the proponents of this viewpoint are willing to accept the fact of high initial development cost prior to any dissemination activity because of the anticipated long-term benefits in *efficacy* and *quality* of the innovation and its suitability for *mass audience dissemination.*

Prototypes of this RD&D model are presumed to exist in industry and agriculture. Figure 2 provides an outline of its major components. Within the field of education major advocates of this viewpoint have been Henry M. Brickell (1961), Francis S. Chase (1968), and David L. Clark and Egon Guba (1965 a and b).

FIGURE 2 THE RESEARCH, DEVELOPMENT, AND DIFFUSION PERSPECTIVE

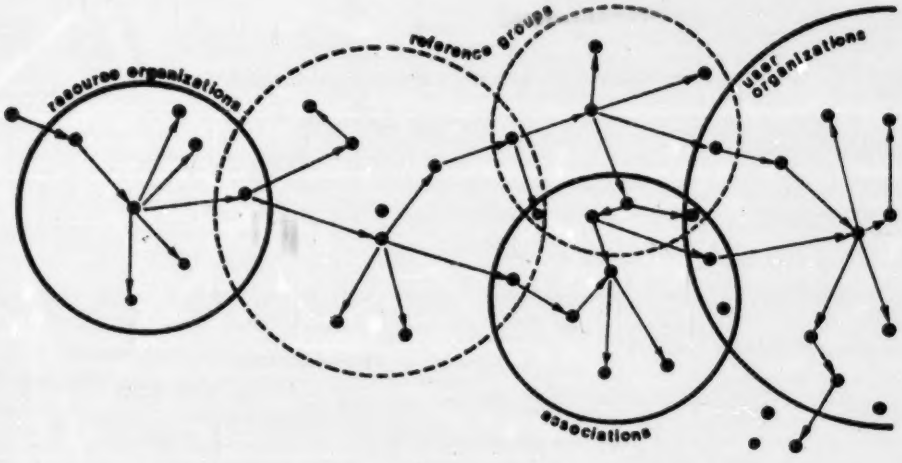


3. SOCIAL INTERACTION (S-I)

A third perspective which we delineated places emphasis on the patterns by which innovations diffuse through a social system. Five generalizations about the process are usually emphasized and are supported by empirical research from rural sociology, medical sociology, and from education:

(1) that the individual user or adopter belongs to a *network of social relations* which largely influences his adoption behavior; (2) that his *place in the network* (centrality, peripherality, isolation) is a good predictor of his rate of acceptance of new ideas; (3) that *informal personal contact* is a vital part of the influence and adoption process; (4) that *group membership and reference group identifications* are major predictors of individual adoption; (5) that the rate of diffusion through a social system follows a *predictable S-curve pattern* (very slow beginning followed by a period of very rapid diffusion, followed in turn by a long late adopter or "laggard" period).

FIGURE 3 THE SOCIAL INTERACTION PERSPECTIVE



Key:
- Individuals in the social system.
- Flow of new knowledge.
- Formal organizational structures
- Informal structures.

Major contributors to the S-I research tradition are Coleman, Katz and Menzel (1966), Ryan and Gross (1943), Lionberger (1960), and E. Rogers (1962, 1971). In education principal proponents have been Mort (1964) and Carlson (1965).

B. PERSPECTIVES ON INNOVATION PROCESS AS RATED BY U.S. SCHOOL SUPERINTENDENTS

Each of these three ideology clusters points to a number of preferred procedures which might be emphasized in innovation process. Therefore, to measure preferences for one ideology versus another, we derived a number of statements which seemed to us to represent these differences most clearly. In all we generated a list of 21 statements. Of these 13 explicitly represented the 3 perspectives outlined above while 8 additional items represented other procedural issues cited by various authors as very important.

The full list, as it was presented to our sample of superintendents, is reproduced in Table 1.

[Insert Table 1 here]

1. A FACTOR ANALYSIS OF PROCEDURES: EMPIRICAL VS. THEORETICAL CLUSTERING

There is no one "right" way to select items for a questionnaire or to group items for analysis and summarization. We have used past theoretical frameworks summarized in an extensive literature review as a guide for the selection of three item clusters. However, it is also possible to cluster these items empirically, using predetermined objective criteria without regard to theory. The most commonly used statistical procedures to achieve clustering fall under the heading of "factor analysis."

Factor analysis has two principal purposes: the first and most common purpose is *data reduction*, i.e., the simplication of data presentation by reducing a large and complex set of item responses to a few key dimensions.

TABLE 1: TWENTY ONE INNOVATION PROCEDURES
Form in which ratings were made and scored.

2. INNOVATION PROCEDURES In the introduction and installation of the innovation identified in Question 1, how much emphasis was given to each of the following?	EMPHASIS				
	Extreme	Major	Moderate	Slight	None
	5	4	3	2	1
a. Systematic evaluation					
b. Solid research base					
c. Systematic planning					
d. Adequate definition of objectives					
e. Selecting a competent staff to implement change					
f. Starting out with adequate financial resources to do the job					
g. Utilizing a number of different media to get the new ideas across					
h. Persistence by those who advocate the innovation					
i. Maximizing chances of participation by many groups					
j. Stressing self-help by the users of the innovation					
k. Adequate diagnosis of the real educational need					
l. Providing a climate conducive to sharing ideas					
m. Providing a climate conducive to risk-taking					
n. Creating awareness of the need for change					
o. Creating an awareness of alternative solutions					
p. Confrontation of differences					
q. Resolution of interpersonal conflicts					
r. Involvement of informal leaders of opinion inside the schools					
s. Participation by key community leaders					
t. Taking advantage of crisis situations					
u. Finding shared values as a basis for working					

A principal components factor analysis does the job using a matrix of correlations of all the items together and creating new artificial variables which represent the most highly intercorrelated sets of items. Each of these artificial variables or "factors" has two statistical properties which are important in data reduction. First, each factor is "orthogonal" to every other factor; hence, they are uncorrelated and should therefore have distinct and non-overlapping meaning; this conceptual purity of orthogonality is offset by the problem of interpretation; if a number of items of seemingly diverse content are represented in a factor, it will be very hard either to label or to comprehend that factor as a unitary phenomenon. The other statistical property of principal component factors is the maximization of variance accounted for by successive factors: the first factor represents the linear combination of variables which represents the most variance; the second factor represents the linear combination of variables which represents the next most variance after all the variance accounted for by the first factor is extracted from the correlation matrix; the third factor represents the next most variance and so forth. This fact is very important for data reduction since it means that an investigator can report as few or as many factors as he wishes with the assurance that the factors chosen represent the maximum explanatory power using that number of concepts.

Because of the difficulty of labelling and interpreting factors from a principal components solution, most investigators rotate the factor matrix to find more easily interpretable dimensions or to achieve what is often called "simple structure." For this analysis we have chosen the "varimax" method developed by Kaiser.* As summarized by Nunnally, this method "maximizes

*Kaiser (1958).

the sum of variances of squared loadings in the columns of the factor matrix. In each column of the matrix, this tends to produce some high loadings and some loadings near zero, which is one aspect of simple structure...The varimax method has proved very successful as a analytic approach to obtaining orthogonal rotation of factors."*

It is also possible to use factor analysis to test previously derived theories about the underlying structure of a set of items. Part of our intention in this project was to test the generalizations from our literature review against a freshly drawn set of data. Therefore, as we consider the results of the varimax factor matrix,we will be referring back, when possible, to the fit or similarity between these clusters and the three theoretical models summarized previously.

Let us turn, then, to the results of this analysis which are contained in Table 2.

[Insert Table 2 here]

It is gratifying to find a set of items which represent such a coherent cluster both statistically and conceptually as we find in Table 2, Factor I. Moreover, the cluster corresponds closely to the "problem-solver" perspective described earlier and predicted from theory. Only two of the items have any substantial relationship to any other factors. Sharing, participation, and self-help are the core ideas. Less strongly related are informal leader involvement, risk-taking, conflict resolution, and competence of staff. We would guess that "competence" on this factor means competence in human relations above all.

*Nunnally (1967), pp. 332-333.

TABLE 2: THE FACTOR ANALYSIS
(Based on complete responses to 21 Procedure items from 296 School District Superintendents)

		Varimax Rotation - Factor Loadings above .20				
		I	II	III	IV	V
FACTOR I	Problem-Solver Perspective					
	Maximizing chances of participation by many groups	.64				
	Finding shared values as a basis for working	.61			-.23	
	Providing a climate conducive to sharing ideas	.60			-.28	
	Stressing self-help by the users of the innovation	.58				
FACTOR II	RD&D Perspective					
	Systematic evaluation		.64			
	Solid research base		.64			
	Systematic planning	.22	.64			
	Adequate definition of objectives	.22	.60			
	Adequate diagnosis of the real educational need	.28	.43			
FACTOR III	Strategic Manipulation					
	Participation by key community leaders		.23	-.71		
	Taking advantage of crisis situations			-.47	-.35	
	Involvement of informal leaders of opinion inside the schools	.39		-.36	-.20	
FACTOR IV	Open Advocacy and Humane Dialectic (Greening of Education?)					
	Confrontation of differences	.21			-.69	
	Resolution of interpersonal conflicts	.32			-.55	
	Creating awareness of the need for change	.29	.31		-.50	
	Creating an awareness of alternative solutions	.28	.26		-.47	
	Providing a climate conducive to risk-taking	.37			-.46	
FACTOR V	Financial Capacity					
	Starting out with adequate financial resources to do the job					.55
COMPLEX ITEMS	Selecting a competent staff to implement change	.31	.32			
	Utilizing a number of different media to get new ideas across	.24	.34			
	Persistence by those who advocate the innovation	.26	.23		-.22	

Turning now to Factor II, it is again gratifying to observe a very coherent cluster of variables, highly related to each other statistically, highly independent of other factors, and all conforming to our prediction of an "RD&D" perspective. It is fairly clear that there is a subgroup of superintendents who follow the RD&D philosophy as distinct from the problem-solver philosophy. Points of agreement between the two schools of thought center on the need for diagnosis and for generating an awareness of the need for change. We would expect, however, that the locus of need identification is seen somewhat differently by the two groups, the problem-solvers emphasizing need awareness and diagnosis by users and RD&D advocates emphasizing need determination by experts. Again for the "competence" item we would guess that a very different type of competence is stressed here, namely competence in research, evaluation, and systematic planning.

Factor III is less clearly tied to our prior theoretical expectations but shows an interesting pattern. Evidently some superintendents view participation by key persons more as a strategic necessity for getting things done than as an aspect of human relations philosophy. The association of the item "taking advantage of crisis " almost suggests a Machiavellian orientation. Clearly Factor III superintendents believe strongly in "social interaction" and utilizing opinion leadership. Factor III may also represent political awareness and concern for handling school district decision making within the larger socio-political arena of the community as a whole. It would be interesting to see if Factor III superintendents have a higher survival rate than their colleagues.

The fourth factor appears to represent the most radical view of the change process among those identified, emphasizing both conflict and openness. It may be closely aligned with a "conflict" model of change and with

the approaches to innovation which might be associated with the "new politics" of education. There is implicit in this cluster the notion that fundamental change is needed and that such change is likely to involve a lot of conflict and risk. It is also implied, however, that differences can be resolved in a spirit of openness through a common recognition of need and shared values.

Summing up Table 2, we see four clear clusters of variables, two of which are closely aligned to our earlier theoretical clusterings. The Problem-Solver and RD&D perspectives are nearly identical empirically and theoretically and they are the two strongest and clearest procedural factors. "Social Interaction" emerges empirically in a cluster including "taking advantage of crisis," suggesting that a better label might be "manipulation of communication and social forces." The one word "Machiavellian" could fit this cluster nicely, provided that no derogation is implied thereby. A fourth cluster, appearing to combine aspects of both linkage and conflict models, may represent the emergent radical-liberal approach to change of the late 1960's.

2. WHAT PROCEDURES ARE EMPHASIZED THE MOST?

While the factor analysis reported in Table 2 intentionally points to differences in viewpoint among our national sample of superintendents, the fact is that there was a generally very broad range of agreement on what is important in introducing innovations. This is well illustrated by Table 3 where we show mean "emphasis" ratings for each item, again grouped according to the statistical factors. It is evident that most of the 21 procedures receive between "moderate" and "major" emphasis (between 3.00 and 4.00) and a fair number receive between "major" and "extreme" mean ratings. The list as a whole is highly endorsed by most superintendents and, indeed, on a subsequent question most indicated that it would represent a useful check-list for planning future innovations.

TABLE 3: DEGREE OF EMPHASIS ON 21 INNOVATION PROCEDURES
(Claimed by national sample of superintendents)

		Mean Ratings* Districts < 80,000 N = 296 to 309**	Districts ≥ 80,000 N = 30
FACTOR I	Problem-Solver Perspective		
	Maximizing chances of participation by many groups	3.65	3.70
	Finding shared values as a basis for working	3.45	3.28
	Providing a climate conducive to sharing ideas	4.11	4.10
	Stressing self-help by the users of the innovation	3.67	3.50
	Problem-Solving Factor Mean	3.72	3.65
FACTOR II	RD&D Perspective		
	Systematic evaluation	3.64	3.73
	Solid research base	3.25	3.34
	Systematic planning	4.12	4.30
	Adequate definition of objectives	4.00	4.27
	Adequate diagnosis of the real educational need	3.98	4.23
	RD&D Factor Mean	3.80	3.97
FACTOR III	Strategic Manipulation		
	Participation by key community leaders	2.84	3.13
	Taking advantage of crisis situations	2.59	2.93
	Involvement of informal leaders of opinion inside the schools	3.50	3.33
	Strategic Manipulation Factor Mean	2.98	3.13
FACTOR IV	Open Advocacy and Humane Dialectic (Greening of Education?)		
	Confrontation of differences	3.31	3.23
	Resolution of interpersonal conflicts	3.26	3.11
	Creating awareness of the need for change	4.03	4.20
	Creating an awareness of alternative solutions	3.44	3.60
	Providing a climate conducive to risk-taking	3.55	3.77
	Humane Dialectic Factor Mean	3.52	3.58
FACTOR V	Financial Capacity		
	Starting out with adequate financial resources to do the job	3.42	3.47
COMPLEX ITEMS	Selecting a competent staff to implement change	4.04	4.30
	Utilizing a number of different media to get new ideas across	3.36	3.30
	Persistence by those who advocate the innovation	4.17	4.10

*5=extreme emphasis, 4=major, 3=moderate, 2=slight, 1=none.
**N's vary from 296 to 309 depending on scorable responses.

The RD&D cluster generally rates highest particularly with very large school districts, but the problem-solver items are also generally strong. The highest single items are (1) "persistence," (2) "systematic planning," (3) "a climate for sharing ideas," (4) "a competent staff," (5) "creating an awareness of the need for change," and (6) "an adequate definition of objectives." These six items, all rated as receiving between "major" and "extreme" emphasis by most superintendents, might make a pretty good quickie checklist of innovation process. They cover three of the four major factors as well as two of the complex items.

It may be of special interest to some observers that the financial factor rates relatively low in emphasis and is independent of other factors. This does not mean, of course, that finances were unimportant, but rather that this aspect was not particularly emphasized in the successful innovations reported.

3. RELATIONSHIP BETWEEN PROCEDURAL EMPHASIS AND OVERALL INNOVATIVENESS

In the same survey each district was also asked to list <u>all</u> major innovations introduced in the 1970-71 school year under five categories, "administration and organization," "instruction," "services and special programs," "curriculum," and "technology." The total number listed was summed across categories to yield a rough "innovativeness" index* with a median of 8 and a range from 0 to 43. This index turned out to have a low but statistically significant correlation with several other variables measured in the survey. The strongest correlation was with the size of the district but several other measures were significantly related to innovativeness independently of size. These included per pupil expenditure, use of media specialists and centers, use of in-service training, use of lay advisory

*The primary purpose of the question was not to yield this index but to provide a comprehensive inventory of innovations nationally from which a reliable and meaningful innovativeness index could be derived.

groups, and the frequency of teacher strikes. While most of these findings are reported elsewhere (Havelock, 1973, a and b), we are here most interested in relationships between the innovativeness score for each district and each of the 21 procedural elements we have been discussing. Table 4 tells the story.

[Insert Table 4 here]

Obviously, the magnitude of these correlations is not at all impressive. However, if you consider for a moment the multitude of different factors that could conceivably influence the number of innovations reported for a given district in a given year, I'm sure you will concede that any statistically significant relationships which emerge are worthy of our attention. Here we find that ten of the 21 items are significantly related, using a criterion probability level for the null hypotheses of .05 or smaller.

Furthermore, we note that the correlation pattern is highly related to the factorial pattern which was illustrated in Table 2. Here Factor IV, labelled "open advocacy and humane dialectic" has clearly the most consistent set of relationships. We can imagine, perhaps, that all those confrontations and stimulations might make for a blooming, buzzing confusion of innovation in some schools.

We also note that emphasis on the problem-solver perspective (Factor I) also seems to generate innovativeness. For the other factors and most of the complex residual items, however, there is virtually no evidence of a relationship. The RD&D perspective, in particular, seems to do little to increase the number of innovations. In fact, when we controlled on size, we found that systematic evaluation was slightly but significantly related in a <u>negative</u> direction. Perhaps we should not be too surprised at this. It would seem that the main thrust of RD&D ideology is to increase the <u>quality</u> but not the quantity of innovations in our schools.

TABLE 4: HOW EMPHASIS ON SPECIFIC PROCEDURES CORRELATES WITH OVERALL DISTRICT INNOVATIVENSS

		r		Sig. Level
FACTOR I	Problem-Solver Perspective			
	Maximizing chances of participation by many groups	.17		(.005)
	Finding shared values as a basis for working	.06		NS
	Providing a climate conducive to sharing ideas	.15		(.005)
	Stressing self-help by the users of the innovation	.16		(.005)
	Mean r for Factor I		.14	
FACTOR II	RD&D Perspective			
	Systematic evaluation	-.07		NS
	Solid research base	.07		NS
	Systematic planning	.07		NS
	Adequate definition of objectives	.04		NS
	Adequate diagnosis of the real educational need	.05		NS
	Mean r for Factor II		.03	
FACTOR III	Strategic Manipulation			
	Participation by key community leaders	.09		(.09)
	Taking advantage of crisis situations	.12		(.04)
	Involvement of informal leaders of opinion inside the schools	.10		(.07)
	Mean r for Factor III		.10	
FACTOR IV	Open Advocacy and Humane Dialectic (Greening of Education?)			
	Confrontation of differences	.14		(.01)
	Resolution of interpersonal conflicts	.21		(.001)
	Creating awareness of the need for change	.21		(.001)
	Creating an awareness of alternative solutions	.12		(.03)
	Providing a climate conducive to risk-taking	.16		(.005)
	Mean r for Factor IV		.17	
FACTOR V	Financial Capacity			
	Starting out with adequate financial resources to do the job	.06		NS
COMPLEX ITEMS	Selecting a competent staff to implement change	-.01		NS
	Utilizing a number of different media to get new ideas across	.08		NS
	Persistence by those who advocate the innovation	.12		(.03)

CONCLUSION

The ideologies of change are never going to be a straightforward subject for empirical research investigation. We have taken one approach here using ratings of 21 change strategy items with one set of respondents. We could have chosen other items and other respondents and perhaps arrived at different conclusions. Nevertheless, I think you will agree that the findings for the factor analysis, especially when coupled with the correlations to innovativeness, are provocative and suggestive. In defense of the list, it should be added that we did try another tactic in this same study to get at innovation strategies by asking the open-ended question: "What was the key factor in making the adoption and acceptance of this innovation successful or unsuccessful?" Coded responses to this question invariably fall within the domain of one or another of our 21 items. Thus, there is some indication that the list is fairly exhaustive. Even so, we hope that our study will provoke other investigations of change ideology using alternative methodologies. In the meantime, we would recommend this list of 21 to the programmatic change strategist who wants to cover all bases.

We concluded our original survey of the change literature with a proposal that the competing ideologies of change should each be seen as elucidating equally important but distinct aspects of a total reality. By their strong endorsement of most of these items, our nationally representative sample of superintendents seems to be agreeing with this judgment.

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